the local weather predictions of the Blue Hill Observatory; M. W. Harrington, on weather prediction in the States and its improvement, together with several other similar papers.—The zodiacal light as related to the aurora, by O. T. Sherman. The author gives tables and curves constructed from a large number of observations, showing (1) the relative elongation of the zodiacal light, from observations taken in March, from 1801–86; (2) corrections to the earth's calculated longitude, being that part of the amount by which the observed position varied from the calculated, which is probably due to zodiacal light; (3) Fritz's auroral numbers for Europe south of the polar circle; and (4) his relative numbers for Europe. The conclusions drawn from the tables are that from 1806–27 there was no observation of the zodiacal light, slight and irregular variation of the earth's motion, and slight and irregular auroras. For the next fifty years each period of elongation of the zodiacal light corresponded with a maximum acceleration of the earth's motion, and a minimum in the aurora. And further, that at the time when the zodiacal light was beyond the earth's orbit, the auroras were few and diminished in number.—Farwell's rainfall scheme. This article (which is unsigned) states that Senator Farwell carried a Bill through the last session of Congress, for testing the possibility of the artificial production of rain by means of explosions. The experiments, which are soon to be tried, are intrusted to the Agricultural Department; the officials, however, are said to have little confidence in the success of the experiment. Mr. Fernow, Chief of the Division of Forestry, gives a long report upon the proposal, together with a summary of the literature of the subject.

American Journal of Science, July.—The solar corona, an instance of the Newtonian potential function in the case of repulsion, by Prof. Frank H. Bigelow. This is a continuation of the author's researches into the laws which regulate the development of the various coronal forms.—Newtonite and rectorite, two new minerals of the kaolinite group, by R. N. Brackett and J. Francis Williams. Taking the composition of kaolin as $Al_2O_3,2SiO_2,2H_2O$, the following series of hydrous silicates of alumina may be derived by eliminating or introducing a molecule of water:—

	Percentage Composition.		
	Al_2O_3	SiO_2	H_2O
(1) Al_2O_3, $2SiO_2$, H_2O ...	42·52 ...	49·99 ...	7·49
(2) Al_2O_3, $2SiO_2$, $2H_2O$ ...	39·57 ...	46·56 ...	13·93
(3) Al_2O_3, $2SiO_2$, $3H_2O$ ...	36·98 ...	43·47 ...	19·55
(4) Al_2O_3, $2SiO_2$, $4H_2O$ ...	34·72 ...	40·82 ...	24·46

From the facts and considerations stated in the present paper it appears probable that three members are known out of the four in the above series, viz. (1) rectorite, (2) kaolin and members of the kaolinite group, and (4) newtonite.—On the intensity of sound; ii. the energy used by organ-pipes, by Charles K. Wead. From the results of experiments with different organ-stops out, it appears that no exact conclusion can be drawn from the loudness of the sound as to the relative quantity of wind required to blow pipes of different construction; thus, the soft Dulciana stop of the organ upon which the experiments were performed took more than half as much wind as the comparatively loud Open Diapason, whilst the pipes of the Trumpet stop required less energy than any others sounding the same note. The results obtained in the case of different pipes of the same stop indicate that the volume of air used per second, and therefore the energy expended per second, varies as the $\frac{3}{4}$-power of the wave-length of the note, or inversely as the $\frac{3}{4}$-power of the vibration-ratio.—New analyses of astrophyllite and tscheffkinite, by L. E. Eakins. The analyses give $R''_4R'_4Si(SiO_4)_4$ as the general formula for astrophyllite. This agrees with that found by Brögger from a discussion of analyses by Bäckström and König. Tscheftkinite does not appear to be a mineral in any strict construction of the word, but merely a mixture.—The minerals in hollow spherulites of rhyolite from Glade Creek, Wyoming, by J. P. Iddings and S. L. Penfield. The authors find that in the rhyolite investigated fayalite occurs in association with abundant quartz of a peculiar development, as the result of the mineralizing action of vapours in the cooling acid lava. In certain hollow spherulites the fayalite is replaced by hornblende and biotite.—Bernardinite: is it a mineral or a fungus?, by Joseph Stanley Brown. From Mr. Brown's examination it appears that the mineral resin from San Bernardino County, California, described by Prof. Stillman in the *American Journal* twelve years ago, is the fungus *Polyporus officinalis*, Fries.—Development of Bilobites, by Dr. Charles E. Beecher.—Gmelinite from Nova Scotia, by Louis V. Pirsson. The optical characters, cleavage, and chemical composition of this mineral have been studied. The result of the crystallographic work points to a distinct difference between it and chabazite, but with regard to twinning and chemical constitution the two appear to be identical. Indeed, gmelinite seems to bear much the same relation to chabazite that enstatite does to hypersthene.—Analyses of *kamacite*, *tænite*, and plessite from the Welland meteoric iron, by John M. Davidson. The conclusion is arrived at that in the Welland siderolite only two distinct nickel-iron alloys occur, viz. *kamacite* and *tænite*, and that the so-called plessite is merely thin alternating lamellæ of the two.

American Journal of Mathematics, vol. xiii., No. 4.—In this number J. Perrott's "Remarque au sujet du théorème d'Euclide sur l'infinité du nombre des nombres premiers" is continued from No. 3, and concluded; the author promising a further article on "L'application du procédé du géomètre grec à d'autres cas de la proposition de Lejeune Dirichlet."—The following papers also appear:—Ether squirts, by Karl Pearson, an attempt to specialize the form of ether motion which forms an atom. The main portion of the paper is devoted to an investigation of inter-atomic and inter-molecular forces.—On the matrix which represents a vector, by C. H. Chapman. The fundamental idea is that the linear and vector function of a vector is simply the matrix of the third order.—Sur une forme nouvelle de l'équation modulaire du huitième dégré, par F. Brioschi.—The index to vol. xiii. is appended to this number, which concludes it.

SOCIETIES AND ACADEMIES.

EDINBURGH.

Royal Society, July 6.—The Hon. Lord McLaren, Vice-President, in the chair.—Mr. John Aitken read a paper on the solid and liquid particles in clouds (see p. 279, July 23).—Prof. Tait communicated a paper by Prof. Chrystal on a demonstration of Lagrange's rule for the solution of the linear partial differential equation, with some historical remarks on defective demonstrations hitherto current. Prof. Chrystal's proof is purely analytical. Prof. Tait remarked that, on quaternionic principles, the problem may be regarded as follows. Let the equation be

$$Pp + Qq = R,$$

where P, Q, and R, are given functions of x, y, and z, and p, q, represent respectively the quantities dz/dx, dz/dy. By the introduction of a new variable, u, this may be put into the form

$$P\frac{du}{dx} + Q\frac{du}{dy} + R\frac{du}{dz} = 0.$$

But du/dx, du/dy, du/dz, are proportional to the direction cosines of the normal to the surface $u = c$, and therefore P, Q, R are proportional to the direction cosines of a tangent line to $u = c$. Hence we deduce, as the equations of a curve which lies wholly on the surface,

$$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}.$$

The integrals of these equations are known to have the form $v = \alpha$, $w = \beta$, where α and β are arbitrary constants. The intersections of these surfaces fill space with a set of lines, and the problem is to find a single general set of surfaces upon which these lines will lie. Their equation is $v = f(w)$, where f is an arbitrary function. It is therefore the integral of the given differential equation.—Prof. Tait read the fifth part of his paper on the foundations of the kinetic theory of gases. He has applied his expresson for the isothermals of a liquid and its vapour to the case of ethyl oxide. The results are in remarkable accordance with the direct observations of Drs. Ramsay and Young. He has also applied the virial method to systems of doublets, triplets, &c. The close correspondence of the results calculated from his formula with Andrews's and Amagat's observations on carbonic acid was somewhat surprising when it was considered that the theoretical results were deduced on the assumption of smooth, hard, spherical molecules, while the molecule of carbonic acid is very complex. In the present part of his paper, Prof. Tait shows that, from the manner in which the (approximate) virial equation is formed, no term depending on internal actions in molecules themselves can appear in it when the number of molecules is sufficiently large. He also discusses the mechanism of equilibrium between liquid and saturated vapour. He has reduced the difficulties of the problem to the evaluation of certain definite integrals.—Dr. John Murray communicated a paper by Mr. J. W. Gregory, of the British Museum, on the Maltese fossil Echinoidea, and their evidence on the correlation of the Maltese rocks. In this paper the fossil Echinoidea of Malta are revised, and many additions to the fauna made by the description of material recently collected. Several genera new to Malta are recorded, and also some species previously known only in Italy. Some changes in nomenclature are advocated: thus, as the author accepts the zoological use of the generic name *Echinanthus*, a new one—*Breynella*—is proposed for the genus known to palæontologists by the former term. In regard to the age of the Maltese beds, the author agrees with Fuchs as to the Lower Coralline limestone being clearly Oligocene; the overlying Globigerina limestone is assigned partly to the Aquitanian and partly to the Langhien: as no sharp line of division can be drawn between these two series, the exact limits of the Oligocene and the Miocene in Malta cannot be precisely determined. The blue clay appears also to belong to the Langhien, and to be hardly entitled to separation from the underlying Globigerina limestone; the greensand is referred to the Helvetian, and the Upper Coralline limestone to the Tortonian. The relations of Echinoid faunas of the different horizons to those of the corresponding beds in other parts of the Mediterranean are considered, and it is argued that deep-sea conditions prevailed in different areas at different times: hence they show merely a series of local subsidences, instead of one great regional depression.—Prof. Ewart communicated the first part of a paper on the lateral sense-organs of *Lœmargus* and *Acanthias*, in which he dealt specially with the sensory canals.—Prof. Tait communicated a paper, by Prof. C. G. Knott, on the electric resistance of cobalt at high temperatures. The cobalt on which Prof. Knott experimented was in the form of a thin strip cut from a sheet in the possession of Prof. Tait. The metal was very pure—containing possibly 1 per cent. of carbon, 0·15 per cent. of silicon, 0·73 per cent. of iron, a very small percentage of manganese, and perhaps 0·1 per cent. of an undetermined metal. The formula $r = a\epsilon^{kt}$, where r is the resistance and t is the temperature, closely represents the results at temperatures above 100° C. This law is identical with that which holds in the case of nickel, but the rate of variation is not so great in cobalt as it is in nickel. When first heated to a very high temperature, profound changes take place in the metal as regards its change of resistance with temperature. The metal resembles nickel and iron in that the rate of variation of its resistance increases rapidly as the temperature rises. But, in nickel and iron, at a still higher temperature, this is followed by a distinct decrease. No such effect is observed in cobalt.—Prof. Tait also read a paper, by the same author, on the thermo-electric positions of cobalt and bismuth. A triple junction of cobalt, bismuth, and palladium was used. A rod of bismuth was formed by breaking the metal into small pieces, and packing them into a siphon-shaped glass tube. Gentle heating fused the pieces, and so a solid rod was formed. The other wires were fused into its ends. The line of this specimen of cobalt, on the thermo-electric diagram, lay, at ordinary temperatures, above that of the specimen of nickel which Prof. Tait used in the construction of the diagram, but a neutral point existed at 100°, because of the greater steepness of the cobalt line. The slope of the line is the greatest which has yet been observed, with the exception of that of the upwardly-sloping portion of the line of nickel. The thermo-electric power of bismuth does not alter in strong magnetic fields, although Righi has shown that its resistance alters in such fields.

SYDNEY.

Royal Society of New South Wales, May 13.—Civil Engineering Section Meeting.—Mr. C. W. Darley in the chair.—The inaugural address was delivered by the Chairman; and a paper read on researches in iron and steel, and working stresses in structures, by Prof. Warren.

June 3.—Mr. W. A. Dixon, Vice-President, in the chair.—Six new members were elected.—The following paper was read:—Notes on the large death-rate among Australian sheep in country affected with Cumberland disease or splenic fever, by M. Adrien Loir, Director of the Pasteur Institute of Australia.—Prof. Anderson-Stuart exhibited his new instrument for demonstrating the manner in which sound-waves are propagated; and Lovibond's tintometer was shown by the Chairman.

PARIS.

Academy of Sciences, July 20.—M. Duchartre in the chair.—The life and works of the late Prof. W. Weber, by M. Mascart.—Observations of minor planets, made with the great meridian instrument of Paris Observatory during the second half of 1890 and the first quarter of 1891, by Admiral Mouchez. The asteroids which have been observed for position are:

㊸, (78), (68), (53), ㊾, ㉔, (134), ⑩, ⑪, ⑥, ㉘, (58), (118).

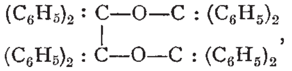
—The third meeting of the International Committee of the map of the heavens: presentation of the Proceedings, by the same author.—Elements of the elliptic comets Swift (1889 VI.) and Spitalier (1890 VII.), by Dr. J. R. Hind.—Evidences that Europe and America have been united during recent times, by M. Emile Blanchard. The evidences given in the author's memoir are derived from a discussion of the fauna and flora of the two continents.—On the glycolysis of circulating blood in living tissues, by MM. R. Lépine and Barral. The authors' method of studying the glycolysis of blood in circulation in an isolated member appears to be more exact than that of studying it *in vitro*. They have used it to prove the diminution of hæmatic glycolysis that occurs in experimental diabetes.—Apparent total disappearance of Jupiter's satellites, by M. C. Flammarion. On July 15, M. Flammarion observed Jupiter when three of his satellites were passing across his disk and one behind it. This rare phenomenon occurs every twenty-three years, a period which contains 523 revolutions of the fourth satellite, 1220 of the third, 2488 of the second, and 4934 of the first. It was first put on record by Galileo in 1611, and M. Flammarion gives a list of seven other observers who have noted it.—Experiments on weirs, by M. H. Bazin.—Vibration of a wire along which an electric current is passing, by M. D. Hurmuzescu. A metallic wire stretched between two supports and traversed by an electric current sets itself in vibration. The amplitude of the vibrations steadily increases and reaches a maximum, which is maintained so long as the current is passing and no changes occur in the conditions of the surrounding medium. For a given tension, the amplitude appears to depend on the difference of temperature of the wire and the medium in which it vibrates; hence it varies as the intensity of the current.—The absorption and photography of colours, by M. Labatut. Using M. Lippmann's method for the photography of the spectrum in its colours, the author has investigated the absorbing action of screens coloured with dyes, such as cyanin, &c., in relation to the parts of the spectrum impressed on the prepared plate and the interference colours produced.—On the composition of atmospheric air: new gravimetric method, by M. A. Leduc. The following represents the results obtained in two experiments:—

	Grms.	Grms.
Weight of air analysed	3·4237	... 3·5551
Weight of oxygen which combined with phosphorus	0·7958	... 0·8249
Percentage proportion of oxygen	23·244	... 23·203

The mean of these values is 23·224, or, roughly, 23·23, which may therefore be taken to represent the percentage of oxygen in purified air. The composition by volume is stated as: nitrogen 78·98 per cent., and oxygen 21·02 per cent.—On silicon selenide, by M. Paul Sabatier. This body has been prepared by passing a current of dry hydrogen selenide over crystallized silicon at a red heat. The selenide obtained is a hard substance, having a semi-metallic appearance, and apparently not volatile at the temperature of the experiment. Its composition, verified by several analyses, is represented by the formula $SiSe_2$.—Melting-point of certain organic binary systems (hydrocarbons), by M. Léo Vignon.—Study of the solid products resulting from the oxidation of drying oils, by M. A. Livache.—On a new method of testing for phenol, by M. L. Carré.—On ozone considered from a physiological and therapeutical point of view, by MM. D. Labbé and Oudin.—On the mode of action of the butyric ferment in the transformation of starch into dextrine, by M. A. Villiers.—On a toxalbumin secreted by a microbe from blennorhagic pus, by MM. Hugounenq and Eraud.—Oscillations of the retina, by M. A. Charpentier. The author has studied experimentally certain phenomena which appear to demonstrate the production of oscillations in the visual organ under the influence of luminous excitations. These movements are apparently due to a reaction of the retina at the moment when light strikes it.—On the innervation of the stomach of Batrachians, by M. Ch. Contejean.—On the development of the mesoderm of Crustaceæ, and on that of its derived organs, by M. Louis Roule.—On the homology of the pedal and cephalic appendices of Annelidæ, by M. A. Malaquin.—On the muscardine of the white worm, by MM. Prillieux and Delacroix.

BRUSSELS.

Academy of Sciences, May 5.—M. Plateau in the chair.—*Linamarine*, a new glucoside from *Linum Usitatissimum*, yielding hydrogen cyanide on hydrolysis, by A. Jorissen and E. Hairs. The method of preparation found to give the best yield is described. This glucoside presents some points of resemblance with amygdalin, but the table of properties discloses many important differences, notably the solubility of the new body in cold water, its melting at 134° *without decomposition*, and the absence of benzaldehyde from the products of its hydrolysis. The elementary analysis of the new glucoside gives the following figures: C, 47·88; H, 6·68; N, 5·55; O, 39·89.—On the pinacone of desoxybenzoïn, by M. Delacre. The author shows that there are two bodies of the formula $C_{28}H_{26}O_2$ obtained by the reduction of desoxybenzoïn, one consisting of glassy needles melting at 210°, and the other obtained in large crystals melting at 163°. He explains the discordance of the results of MM. Limpricht and Schwanert and M. Zagumenny as being due to the former having obtained the mixed bodies, and hence determined the melting point at 156°.—On the constitution of α-benzopinacoline, by M. Delacre. The author gives a complete chemical and physical study of the properties of this body; he concludes that α-benzopinacoline is not a pinacoline but the ether of benzopinacone, and that its constitution would be expressed by the formula



$$\begin{array}{l}(C_6H_5)_2 : C{-}O{-}C : (C_6H_5)_2 \\ \qquad\quad\;\; | \\ (C_6H_5)_2 : C{-}O{-}C : (C_6H_5)_2\end{array},$$

thus making its molecular weight double that he previously assigned to β-benzopinacoline. The data given in the paper for the determination of the molecular weight of the α-benzopinacoline by the cryoscopic and vapour tension methods would lead to the adoption of the same molecular weight as in the case of the β-benzopinacoline.—On the rate of formation of compound ethers, by N. Menschutkin. A study of the velocity of etherification of some thirty-two alcoholic derivatives, comprising primary and secondary saturated alcohols, tertiary alcohols, primary unsaturated alcohols, alkyl chlorides, alkyl cyanides, and ethers. Acetic anhydride was employed as etherifying agent, as by its use no water was produced, and thus the complication of the problem by the introduction of reversible reactions was avoided. The velocity of etherification of methyl alcohol is the greatest; the substitution of any element or group of elements for hydrogen in the molecule CH_3OH invariably decreases the velocity of the reaction.—Theorems on the curvature of algebraical curves, by Prof. Cl. Servais.—On the "attractive spheres" in some vegetable cells, by E. de Wildeman.—Crystallographic note on albite from Revin, by M. A. Franck.

CRACOW.

Academy of Sciences, May.—On the expansion and compressibility of atmospheric air, by A. W. Witkowski. The author has made experiments with air between the temperatures 100° and − 145° C., and at pressures up to 130 atmospheres. The coefficient of expansion (α) has been found at the constant temperatures 100°, 16°, − 35°, − 78°·5, − 103°·5, − 130°, − 135°, − 140°, and − 145°, by varying the pressure. The values obtained for these nine isothermals are tabulated and represented graphically. From the isothermal curves it appears that the coefficient of expansion increases up to a maximum in each case, and then diminishes. The increase is most rapid near the liquefaction points. All the curves tend towards a point the co-ordinates of which are $p = 1$ atmosphere, and $\alpha = 0·00367$. The values expressing the compressibility of air have been calculated from the expansion coefficient.—An electrical thermometer for low temperatures, by the same author. The fact utilized in the construction of the instrument is the variation of the resistance of a platinum wire at different temperatures. From the experiments it appears that this is about 2 ohms per degree. It is therefore easy to obtain a sensibility of $\frac{1}{20}$ of a Centigrade degree. The relation between the temperature and the electrical resistance is subject to slight variations if the thermometer is employed for widely different temperatures. This fact has been noted by previous experimenters.—On derivatives of *m*-methyl-*o*-uramidobenzoyls, by S. Niementowski.—On the critical pressure of hydrogens, by K. Olszewski.—Mathematical notions and methods, by S. Dickstein.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Réunion du Comité International Permanent pour l'Exécution de la Carte Photographique du Ciel (Paris, Gauthier-Villars).—Solutions of the Examples in Charles Smith's Elementary Algebra: A. G. Cracknell (Macmillan and Co.).—The Right Hand: Left-Handedness: Sir D. Wilson (Macmillan and Co.).—The Positive Theory of Capital: E. V. Böhm-Bawerk, translated by W. Smart (Macmillan and Co.).—Outside the Class-room: Thoughts for Young Engineers: W. H. Bailey (Manchester, Cornish).—The Skeleton of the Irish Giant, Cornelius Magrath; D. J. Cunningham (Williams and Norgate).—Die Jährliche Parallaxe des Sterns Oeltzen 11677: Dr. J. Franz (Königsberg).—The Photochronograph and its Application to Star Transits (Washington),—The Geological and Natural History Survey of Minnesota, Eighteenth Annual Report, 1889: N. H. Winchell (Minn.).—The Iron Ores of Minnesota: N. H. Winchell and H. V. Winchell (Minn.).—Thirty-eighth Report of the Department of Science and Art (Eyre and Spottiswoode).—Abbildungen zur Deutschen Flora: H. Karsten's (Berlin, Friedländer).—Anatomie des Hundes: Dr. W. Ellenberger and Dr. H. Baum (Berlin, P. Parey).—The Telescope: J. W. Williams (Sonnenschein).—Les Engrais Chimiques: Tome Premier, Les Principes et la Théorie: M. G. Ville (Paris).—An Explanation of the Constitution of the Ether, of the Constitution of Matter, and of the Cause of Universal Gravitation: J. G. Vine (Reeves).—Peabody Institute of the City of Baltimore, Twenty-Fourth Annual Report, June 4, 1891 (Baltimore.)—Proceedings of the Boston Society of Natural History, vol. xxv., Part 1 (Boston).—Notes from the Leyden Museum, vol. xiii., No. 2 (Leyden, Brill).—Contributions from the U.S. National Herbarium, vol. i., No. 4 (Washington).

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